PREHISTORIC AND MODERN IMPACTS ON GULLY FORMATION ON THE LOESS HILLS OF NORTHERN MISSISSIPPI, USA

Dotterweich, M.*, Jared David, M.

Institute for Environmental Sciences, University of Koblenz-Landau, Fortstrasse 7, 76829 Landau, Germany.
*mail@markus-dotterweich.de

1. Introduction

The Loess Hills of Northern Mississippi are underlain by Marine and Fluvial sediments deposited during the upper Cretaceous through the Paleocene. These deposits were subsequently covered by Loess or by Forest and Grassland Soils throughout the Pleistocene and consist largely of materials with a particle size of fine-sand or smaller, and are above all, highly erodible. During the Holocene, these soils and sediments were repeatedly exposed, eroded, and trans-located by fluvial systems.
Approximately 7,000 years ago, during the *Middle Archaic* period, Native Americans began to modify the land through Agriculture and the building of Earthen Works, the most remarkable of which are their ceremonial or burial Mounds. Archeologists are now trying to rebuild the rise and collapse of their societies as settlements expanded, only to later abandon the site when resources became limiting. Europeans, beginning in the 1530's, brought with them new ideas, technologies, and landuse practices. Many of these landuse practices where ill-adapted to the geomorphic reality of the 'Loess-Plains Upland Forest & Grassland Complex'.
The widespread implementation of mechanized Forestry and Agriculture during the early 1900's resulted in the reduction of up to 80% of the *Uplands*. Vast *Badland* area development provided us with the best documented (photographs and written accounts, though not scientific in origin) example of anthropomorphically induced erosion in the region (Fig. 1-3). More in depth records are preserved within the sediments, and are recorded as *catastrophic erosion events*, which often forced the abandonment of the land. In order to reconstruct the *Holocene landscape evolution*, we are utilizing a interdisciplinary approach combining the fields of *pedology*, *environmental geography*, *geoarchaeology*, and *archaeology*.

Here we will present 2 sites that will help us to understand the *processes that drive gully formation* in the uplands of northern Mississippi and how these processes are affected by *anthropomorphic influences*. Briefly, the sites are:

Owl Creek Indian Mound Site, occupied by humans at least 3,000 years B.P. with the extant remains of *Indian Mounds*, *Wagon Road*, *Homesteads*, *and Landuse Management*.
Charley Cooper Site, exhibiting a European settlement *Wagon Road* from the early 1830's (perhaps from the 1700's) which was quickly abandoned due to erosion.

Fig. 1. Logging of the trees in the 19th century. In a few decades nearly the whole state was deforested. Intensive agriculture enabled soil erosion leading to extensive badlands (Picture: USDA Forest Service)

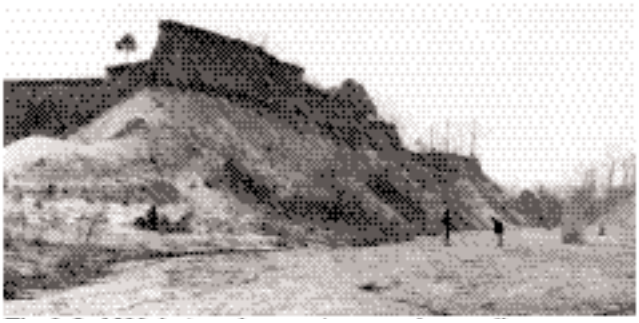

Fig. 2. In 1929 during a heavy rainstorm a huge gully was cut. Barns and houses were destroyed. In a few decades 80 % of the loess hills of North Mississippi were transformed into badlands (Picture: USDA Soil Conservation Service).

Fig. 3. To avoid further soil erosion in 1948 a reforestation program was started. During the first 15 years, up to 50 million trees/year were planted over an entire area of 1.8 million ha (Picture: USDA Soil Conservation Service).

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2. Results and Discussion

2.1. Owl Creek Indian Mound Site

During the early Holocene sandy sediments where deposited on top of a Cretaceous Mudstone, resulting in forested swamp as indicated by pollen analysis and dated wood remains. A series of truncated alluvial floodplains developed upon sand which where then covered by a silty deposit in which a Mollic horizon developed until the end of the agricultural period of the Mississippian Mound building Indian (~1000 to ~1200 AD). Subsequent catastrophic deposition of sands transformed these fields into a broad braided river fluvial system as revealed by a survey conducted before European settlement in the 1830's. The new surface was not reclaimed for agriculture until the advent of mechanised farm equipment. In the first half of the 20th Century a drainage ditch across the floodplain was built. Intensive run-off led to gullying cutting of the sediments of the floodplain (Fig. 4).

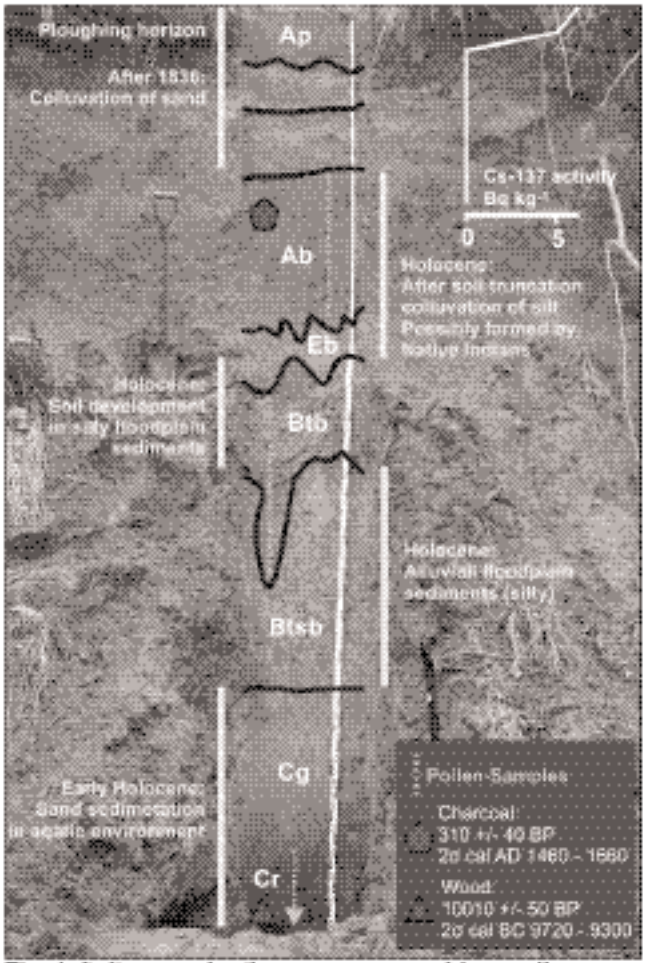

Fig. 4. Sediment and soil sequence truncated by a gully near an Indian Mound site at Owl Creek.

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2.2. Charley Cooper Site

At the end of the Pleistocene a thin Loess cover laid over the marine sand forming an undulating surface (Fig. 5, Phase 1). During the Holocene period until 1835 soil formation was the dominant process. But natural and / or anthropogenic caused woodland fires combined with Indian agriculture enabled intensive sheet erosion of the highly erodible loess material up to 2 m (Phase 2). In the 19th a wagon road and intensive agriculture caused gullying along the thalweg (Phase 3). In the early 20th century land use switched into forest. Only along forest roads and along the gully soil erosion is active (Phase 4).

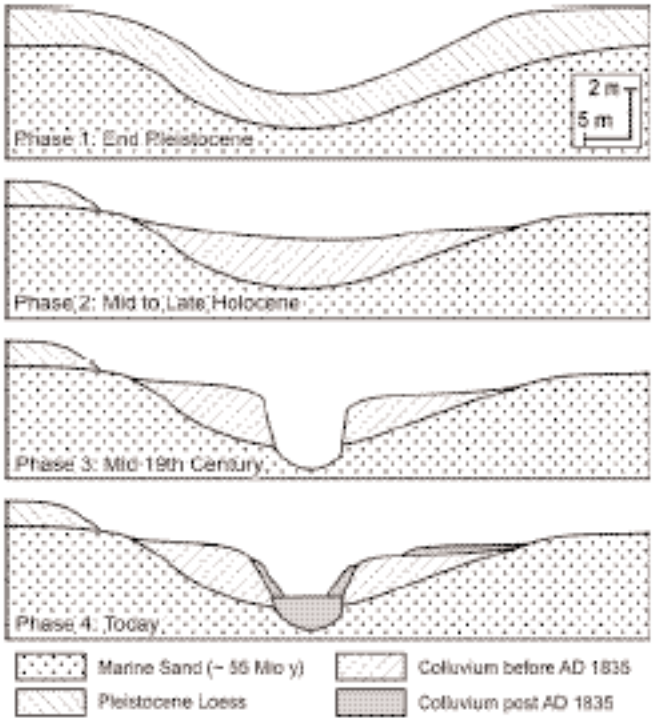

Fig. 5. Cross section through a sediment sequence at Charley Cooper Site

3. Conclusion

Intensive rainstorms and highly erodible material make the landscape in the uplands of North Mississippi extremely vulnerable to soil erosion. It might be possible that extensive land use by the Native Indians or / and natural wood fires cleared the vegetation so that soil erosion occurred. But for this period we haven't found any traces of gullying yet. The results give us a first idea that Native Indians triggered soil erosion. But their impact to the landscape and soil development is still unclear and much more research is needed to determine these interactions.

As White men came into this region in the early 19th century they found still highly fertile soils. Deforestation and farming caused intensive erosion and in a very short time nearly all the soil was eroded and the landscape was gullied into badlands.